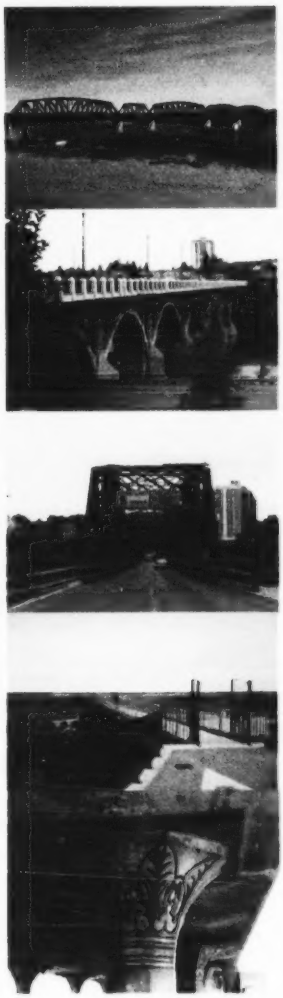
Saskatchewan Road and Railway Bridges to 1950: An Historical Overview

for

Saskatchewan Tourism, Parks, Culture and Sport



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The Heritage Resources Branch of Saskatchewan Tourism, Parks, Culture and Sport administers programs that facilitate the conservation and promotion of heritage property in Saskatchewan. An important part of this work is the identification and research of historic places that are significant for their contribution to Saskatchewan's history and, therefore, potential candidates for designation as Heritage Property under *The Heritage Property Act*.

In 2007, Ross Herrington was commissioned to research and write an inventory and short history of pre-1950 road and rail bridges in Saskatchewan and to research 10 bridges which are noteworthy for their architecture, engineering or association with people, events, organizations or use. It is hoped that this information will be of interest to owners, municipal governments and others concerned with the history of the province's bridges and will prompt efforts to recognize and celebrate these important structures

The study was completed as part of Saskatchewan's commitment to the Historic Places Initiative. The Historic Places Initiative is a Federal/Provincial/Territorial partnership established by the Government of Canada in 2001 to foster appreciation for historic places and increase Canada's capacity to conserve and maintain these places.

The views and conclusions expressed in this report are those of the author and do not necessarily represent those of Saskatchewan Tourism, Parks, Culture and Sport nor the Historic Places Initiative Partners

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Introduction

As part of Saskatchewan's built heritage, railway and traffic bridges have played an important role in the pattern of settlement and in the economic development of Saskatchewan. In spite of this importance, however, only limited research and analysis has been undertaken to date concerning Saskatchewan's traffic, rail and pedestrian[1] bridges. For example, two reports on the province's road bridge network were prepared for Saskatchewan Culture, Youth and Recreation (now the Ministry of Tourism, Parks, Culture and Sport) in the late 1980s. The first report[2] provided an inventory of approximately 500 road bridges as well as documenting the administrative history of bridge construction in the province. The second report[3] summarized bridge types, bridge length, and the purposes of bridge construction, and included a preliminary analysis of bridge site selection and design.

An inventory of the most significant railway bridges in Saskatchewan was prepared in 1996 for the Saskatchewan Heritage Foundation.[4] While this was not a comprehensive survey of all railway bridges, it does provide a general context for how the major railway companies developed and expanded their rail networks across the province. It should be noted that no comprehensive inventory is possible since neither CP rail nor CN Rail has provided full access to their databases.

This current research report adds to the research work already completed. It provides an overview of road and railway bridge development in the province between the 1880s and

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[1] It has been estimated that the province had constructed at least 5400 road bridges by 1950.

[2] Neufeld, David, "Saskatchewan Road Bridges", draft report prepared for Saskatchewan Culture and Recreation, 1987.

[3] Neufeld, David, "Saskatchewan Road Bridges: 1898-1951", research report prepared for Saskatchewan Culture, Youth and Recreation, c1989.

[4] Kozma, Leslie S., "A Survey of Railway Bridges in Saskatchewan: 1882 to 1996", report prepared for the Saskatchewan Heritage Foundation, 1996.

about 1950.[5] It also provides a short narrative history of bridges and provides the context for bridge construction within the evolution of the road and railway network. Unlike the previous reports, this report focuses more on the stylistic, design, and engineering materials as reflected through the evolution of bridges in the province and sets the potentially provincially-significant bridges within the context of this evolution.

In conjunction with this narrative report, the author has prepared Statements of Significance for ten bridges which have the potential to be of significant heritage value at the provincial level. These Statements were prepared separately as part of this overall contract. Since no bridges in Saskatchewan have been designated under *the Heritage Property Act* as Provincial Heritage Property and only five are recognized as Municipal Heritage Properties, this information will be useful in research work being undertaken by the Ministry of Tourism, Parks, Culture and Sport as part of the Historic Places Initiative, and for identifying structures which may be of provincial significance..

Traffic Bridges

Development of Saskatchewan's Road Network

The typical means of travel of the early settlers was by horse or wagon and, as such, the "highways system remained a patchwork of roads and trails that were predominantly used by horse and buggy for most of the province's early days."[6] These early trails connected trading posts and isolated settlements and followed as direct a route as possible, generally crossing streams at the best fords and avoiding major landscape features such as wetlands and sloughs. Thus, these trails tended to lead in all directions. Some examples of these trails used in the late 1880s included: Fort Pelly to Fort Ellice; Fort Ellice to Edmonton House via Fort Carlton; Regina to Loon Creek; Craven to Long Lake; Moose Jaw to the south; Fort Qu'Appelle to Prince Albert; Indian Head to Pheasant Plains; Grenfell to Qu'Appelle Valley; Humboldt to Prince Albert; Battleford to the south; Fort Carlton to Saskatoon; Fort Qu'Appelle to Fort Walsh; and the Boundary Commission Trail.[7]

Once settlement progressed, and the land became farmed, traffic was forced to follow "the routes surveyed and reserved for road purposes."[8] Unfortunately, the road allowances established through the Dominion Land Survey system presented highway and bridge engineers with considerable challenges. It often seemed that an "undue proportion of sloughs, lakes, bad hills and awkward bridge locations"[9] occupied the road allowances. This required diversions, many of which still exist on Saskatchewan's present roads.

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[5] Research has revealed that none of the few pedestrian-only bridges constructed in the province prior to 1950 has survived.

[6] From Trails to Highways, 1900 to 1945, Pat Rediger, Road Builders and Heavy Construction Association of Saskatchewan, 2006, p.3.

[7] The Story of Canadian Roads, Edwin C. Guillet, 1967, University of Toronto Press, p.110.

[8] Annual Report of the Department of Public Works for 1906, p.22.

[9] "Development of Saskatchewan's Highway System", Charles W. Dill, *The Canadian Engineer*, Vol. 38, Feb. 19, 1920, p.224.

Prior to the First World War, the rapid settlement of the land and the extension of the railroad network, which in turn fostered the development of new towns, resulted in the need for a comprehensive road-building scheme. The province formed a three-member Board of Highway Commissioners in 1912 to implement highway improvements. The roads leading out from the market towns and grain elevator points located along the railroads generally were the first to be improved. The provincial policy at the time was to provide matching grants to municipalities whereby the building and improvement of roads could take place at locations approved by the government. In general, provincial grants were "expended chiefly upon main roads, the subordinate roads to be cared for by locally collected funds."[10]

In 1918 Saskatchewan Highways undertook a revision of the plan for the provincial main road system. The Board of Highway Commissioners had drawn up plans in 1912-13 for each rural municipality, but conditions had changed considerably by 1918, including the impacts of railroad expansion, new settlements, and new market centres, such that the government needed to revisit main road priorities. In addition, the increase in the number of automobiles influenced the location and relative importance of the main roads.[11] The Main Roads plan, submitted to the federal government in early 1919 for approval under the new Canada Highways Act, identified a main highway system connecting adjoining market points along the railways as well as cross-country roads running generally north and south.[12] This plan largely determined the future direction of provincial highways.

The importance of the automobile cannot be overlooked in the demand for more and better roads and associated infrastructure. The creation of local automobile associations, as early as 1903 in Ontario, for example, and the expansion of these lobby and support groups into provincial organizations and the Canadian Automobile Federation in 1913 (the name was changed the following year to the Canadian Automobile Association) added their voices to this demand for roads.[13] The Good Roads movement, which was initiated with the formation of the Ontario Good Roads Association in 1894, and then led to the Canadian Good Roads Association in 1917, was instrumental in Canadian highway development. Compared to the automobile clubs, this was largely a professional organization comprised of road builders, engineers and other public officials. These individuals were well-placed to influence highway and bridge evolution.

The Canada Highways Act of 1919 resulted in intensive road building activity throughout Saskatchewan, beginning in 1921.[14] This Act was originally designed as a five-year program but subsequently was extended an additional three years.

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[10] "Development of Saskatchewan's Highway System", Charles W. Dill, *The Canadian Engineer*, Vol. 38, Feb. 19, 1920, p.222.

[11] Annual Report of the Department of Highways for 1918-19, p.11.

[12] Annual Report of the Department of Highways for 1918-19, p.10.

[13] Building Canada: A History of Public Works, Norman R. Ball, Senior Editor, 1988, University of Toronto Press, p.37.

[14] "Two east-and-west and four north-and-south main highways being completed to an all-weather standard", Hon. A.C. Stewart, The Canadian Engineer, 59 (13), September 23, 1930, p270.

The construction and maintenance of bridges, especially the larger ones, remained a provincial responsibility. The provincial policy at the time was to "provide permanent bridge structures of either steel or concrete, and either concrete or galvanized steel culverts" while timber bridges or wooden box culverts were permitted on secondary roads.[15]

By 1928 the provincial government had begun to gravel the highways of Regina, Moose Jaw, Saskatoon, Yorkton and North Battleford. This was designed to reduce the cost of maintenance of earth roads where traffic was heaviest.[16] By the end of 1929 the province had 4100 miles of standard earth roads and 840 miles of gravelled roads. An additional thirty-eight miles were surfaced with gravel and oil.[17] Pressure was put on the bridge building program to provide adequate bridges.

As early as the fall of 1929 several municipalities experienced crop failure due to the severe drought that summer. This situation worsened in the following years to the point where significant provincial and federal financial resources were needed to provide employment relief. Relief work was designed to minimize materials costs and maximize 'pick and shovel' work, but projects had to be "legitimately useful on more than just work-creation grounds."[18]

The construction of roads and bridges during this period remained the provincial government's first priority for providing relief. The Albert Memorial Bridge was Regina's first major unemployment relief work project but there were others. The federal Department of Public Works assumed the responsibility for construction of such major bridges as the Broadway Bridge in Saskatoon, the Ceepee Bridge near Borden, and the Outlook Traffic Bridge, to provide some measure of financial support to local unemployed men. For example, work on the Broadway Bridge started in December 1931 and during the next six months over 1400 men were employed in its construction.

The provincial government started to develop a system of trunk routes east and west and north and south as all-weather gravel surfaced roads. At the same time it was necessary to erect new bridges and replace older ones. In 1929 the province owned and maintained 3170 bridges longer than a 20-foot span, 2760 of which were older timber structures on pile bents.[19] The province decided that an ambitious bridge program was necessary to

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[15] "Development of Saskatchewan's Highway System", Charles W. Dill, *The Canadian Engineer*, Vol. 38, Feb. 19, 1920, p.224.

[16] Rediger, Pat, 2006, From Trails to Highways, 1900 to 1945, Road Builders and Heavy Construction Association of Saskatchewan, p.6.

[17] "Two east-and-west and four north-and-south main highways being completed to an all-weather standard", Hon. A.C. Stewart, The Canadian Engineer, 59 (13), September 23, 1930, p270.

[18] "'Thousands of our men are getting practically nothing at all to do': Public Works Relief programs in Regina and Saskatoon, 1929-1940", Patrick H. Brennan, *Urban History Review*, Vol. XXI, No. 1 (Oct. 1992), p36.

[19] "Two east-and-west and four north-and-south main highways being completed to an all-weather standard", Hon. A.C. Stewart, The Canadian Engineer, 59 (13), September 23, 1930, p270-A.

"replace all the old timber bridges in a period of five years, and that creosoted timber should be used instead of the untreated timber which had been used in the past."[20]

When the Depression started, the federal Conservative government under R.B. Bennett proposed building a trans-Canada highway as a make-work project. Provinces could designate which highways would be part of this national system but indecision by some provinces delayed a timely implementation of this plan. When the Liberals returned to power in 1935, there was even less interest in Bennett's plan.[21]

The Second World War once again put pressure on Saskatchewan Highways and Transportation to address transportation infrastructure needs. The labour shortage and unavailability of building materials and equipment for non war-related activities resulted in a further deterioration in existing road and bridge infrastructure. In 1944, an extensive program of highway construction work was proposed to address this serious problem. Of major concern to the Department was the large inventory of timber bridges erected in the 1920s. The responsibility for maintaining many of these structures was eventually transferred from the province to either the Rural Municipalities or the new Department of Rural Development.

The production of civilian vehicles ceased in Canada in 1942 as the government focused on essential military equipment. When production resumed in August 1945, three-quarters of a million additional vehicles were added in Canada over the subsequent five-year period. An aggressive road building program in the late 1940s resulted in over 90% of the provincial road system being upgraded to modern highway standards. Saskatchewan now had a well-planned highway system with the main routes paved and secondary roads graveled. The Trans-Canada Highway Act of October 1949 and further negotiations with provinces meant that the Trans-Canada Highway would finally be a reality. Saskatchewan would hold the honour in late 1957 of being the first province to "finish paving all 406 miles of its portion."[22]

Jurisdictional Organization

From 1877 to 1892, bridges, road improvements, ferries, surveys and other public works were "carried out under the personal direction of the Lieutenant Governor as agent for the Department of the Interior, through which the affairs of the North-West Territories were then administered."[23] Pubic works projects undertaken during this period, with the exception of bridges over the Souris and Qu'Appelle rivers, generally were small and inexpensive and suited to the sparsely settled character of the Territories.

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[20] "Two east-and-west and four north-and-south main highways being completed to an all-weather standard", Hon. A.C. Stewart, The Canadian Engineer, 59 (13), September 23, 1930, p270-A.

[21] Building Canada: People and Projects that Shaped the Nation, Jonathan F. Vance, 2006, Penguin Canada, p.42.

[22] Building Canada: People and Projects that Shaped the Nation, Jonathan F. Vance, 2006, Penguin Canada, p.49.

[23] Annual Report of the Department of Public Works of the North-West Territories, January 2, 1899, p.7.

In 1892, the Executive Committee of the Legislative Assembly, rather than the Lieutenant Governor, was granted control over expenditures of the Territorial Government. Since there was no separate public works department at this time, funds were equally divided between the electoral districts and local members of the Legislative Assembly. This system of grants, while generally effective given the small available expenditures, did not recognize geographical features, such as large rivers, which required considerable expenditures to bridge, and the possibility of misappropriation of funds for political ends. For these and other reasons, the Executive Committee created a distinct Public Works Branch effective July 1, 1897.[24]

The Branch was organized into seven public works districts with each having a District Engineer and District Surveyor,[25] as well as a headquarters group in Regina. By the spring of 1898, it had become apparent that the system was not working effectively since not all Districts had the same work loads. Local Inspectors were hired on a contract basis to assist but this also proved unsuccessful. By January 1899, an Assistant Chief Engineer and Assistant Chief Surveyor, located in Regina, replaced the District Officers. Additional Local Inspectors were retained to report on completed projects. The effect of these changes was to reduce local political involvement in public works and replace this with 'qualified technical officials'.

The Province of Saskatchewan was created on August 31, 1905 and the affairs of the Territorial Government wound down. The Department of Public Works continued with only minor changes to meet immediate requirements but their program of road and bridge construction had expanded considerably to keep pace with settlement. The southern part of the province was organized into Local Improvement Districts and each LID collected its own taxes for road and bridge improvement purposes. Unfortunately, these funds were not sufficient and LIDs had to appeal to the Department for additional funding. The Department was forced to retain bridge crews capable of handling large and small bridges. It also became essential that the province needed to "inaugurate a main road system throughout the length and breadth of the Province." These main roads would ensure that all farmers would be within a reasonable distance of elevators and "laterals [would be] extended...in every direction so that within a very few years every settler would have a 'good road to town' within a few minutes travel from his farm."[26]

The government established the Board of Highway Commissioners in early 1912 to meet the increasing demand for more and better roads. The Department of Public Works "retained the work in connection with the construction of timber bridges and steel bridges on timber abutments" while an Order-in-Council transferred the responsibility for steel (capital) bridges on concrete foundations to the Board.[27]

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[24] The first Annual Report of the Branch was submitted on January 2, 1899 for the year 1898.

[25] These were not paid officials of the Branch but were local men who were in effect contracted by the Branch.

[26] Annual Report of the Department of Public Works for 1906, p.8.

[27] Annual Report of the Department of Public Works, for period ending February 28, 1913, p.8

Following a Royal Commission to investigate alleged fraudulent activities in highway and bridge construction under the Board of Highway Commissioners, these activities were transferred from the Department of Public Works officially on April 1, 1917 when the Highways Act came into effect. One immediate outcome of this legislation was the creation of Saskatchewan Department of Highways.[28]

During the war years, the shortage of manpower and capital resulted in a significant slowdown in the building of provincial infrastructure. The priorities of the public transportation sector were directed towards those projects necessary to maximize grain deliveries. Towards the end of hostilities the province was divided into public improvement districts. A District Superintendent became responsible for all road work and timber bridge construction in his area. The larger bridges remained the responsibility of the Bridge Branch within the new Department of Highways.[29]

The government changed the name and mandate of this Department to Saskatchewan Highways and Transportation on September 1, 1934.

Technological Evolution of Saskatchewan's Traffic Bridges

From a broad, non-engineering perspective, the evolution of traffic bridge construction in Saskatchewan may be considered to have been shaped by either the need to develop a provincial road network which would integrate with the existing railway system, or to use public money as levers to manage the provincial economy.

From an engineering perspective, the selection of the type of bridge to be constructed not only depends on the specific site to be crossed but also on the prevailing bridge construction technology and its cost-effectiveness. As structures reach, and often exceed, their useful lives, decisions are made about whether a new structure is still needed at that crossing, whether the route needs to be re-aligned, and what type of engineered structure would be most appropriate. The significant cost of this type of work requires considerable analysis.

Types of Traffic Bridges

There are several approaches to understanding the chronological evolution of road bridges in Saskatchewan. One system classifies bridges essentially by their superstructure length. For example, the Annual Report for the Saskatchewan Department of Public Works for 1906 states that "the bridges constructed by the Department may be divided into three distinct classes, namely: the permanent structures spanning the large rivers, the small steel bridges crossing the smaller rivers and the timber bridges necessary to cross small streams, spring runways, ravines and the deep portions of marshes.[30] Another classification system considers the construction materials used and the development of

[28] Annual Report of the Board of Highway Commissioners for fiscal year ending March 31, 1917, p.7.
[29] Annual Report of the Department of Highways for 1917-18, p.10.
[30] Annual Report of the Department of Public Works for 1906, p.9.

engineering technology.[31] In this case, bridge types would include timber, steel and concrete.[32] For the purposes of this overview report, the latter system will be used as a framework. It should be noted that what follows is neither an exhaustive nor an overly technical summary of these bridge types, and the discussion is focused on bridge designs that have been applied in Saskatchewan.

a. Timber Bridges

Timber structures on piles or trestles offered a cheap solution to crossing narrow streams and other impediments to road travel, particularly where materials and local skilled labour were readily available. These structures, which were considered to be temporary since they were subject to rapid deterioration, were typically constructed on secondary roads where spring or summer floods were not prevalent. Their average life expectancy was around fifteen years. Creosoted timbers were not commonly used in the very early Saskatchewan bridges because of the additional cost.

Wooden truss bridges started to appear in America, and to some degree in eastern Canada, such as the covered bridges in Quebec, New Brunswick and Ontario, in the early-nineteenth century. In Saskatchewan in the late nineteenth and early-twentieth centuries, timber pony[33] trusses were often used to span relatively narrow crossings. Larger spans required heavier timbers and were often of Howe through[34] truss design. None of these timber pony or through trusses has survived.

Timber trestle bridges were often used by railways to cross rugged areas and this design was used occasionally for road crossings in southern Saskatchewan. This type of structure was not suited to rivers which had high spring runoff and significant ice runs.

b. Steel Bridges

The first wrought iron bridges resembled the wooden trusses they were designed to replace. Iron initially replaced the tension members in wooden trusses and gradually complete bridges were constructed from this material. By the late-1800s steel had replaced wrought iron. The United States was in the forefront of iron truss design with much of the impetus for these bridges coming from the railways. The Pratt truss was patented in 1844 and several modifications and other truss designs, such as the Warren,

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[31] See, for example, *The Western Municipal News*, 1927, "Bridges in Saskatchewan", A.P. Linton, Chief Bridge Engineer, Saskatchewan Department of Highways, pp. 319-320 (paper presented at the 1927 Convention of the Canadian Good Roads Association).

[32] The use of other building materials in bridge construction, such as masonry or stone, is rare in Saskatchewan. A fieldstone bridge was constructed at the Saskatchewan Hospital at North Battleford but this may be unique.

[33] A pony truss is a bridge in which the trusses are extended a couple of metres or so above the level of the roadway and are not connected to each other across the roadway.

[34] A through truss is a bridge in which the trusses rise above the level of the roadway and are connected to each other above the roadway. The Howe Truss was patented in 1840 and has vertical members and diagonal members slanted towards the abutments.

Parker and Petit, quickly followed. These steel bridges continued to be erected in Saskatchewan into the inter-war period.

Steel truss bridges can be categorized by their relationship to the traffic they are designed to accommodate. In a deck truss, traffic travels on top of the main structure. In a pony truss, traffic travels between parallel superstructures which are not cross-braced at the top. In a through truss, the structural steel is higher and is cross-braced above the traffic. Pony trusses are smaller and lighter structures and are used to cross narrow spans. For longer spans the steel truss was the through type. By around 1900, both pony and through truss steel bridges had become common throughout the province.

Saskatoon's "Traffic Bridge", completed in 1907, and the two bridge sections crossing the North Saskatchewan River at Battleford (1909) were the first heavy steel Parker through truss spans erected on concrete piers in Saskatchewan.

c. Reinforced Concrete Bridges

Reinforced concrete bridge designs include: beam bridges; earth-filled arches; bowstring arches; and, rigid frame bridges.

The reinforced concrete beam, or girder, bridge is suited to short spans. In early 1910, the province prepared plans for their first reinforced concrete beam bridges, one west of Estevan and one south of Weyburn. These 20-foot bridges had flat slab floors which were reinforced in two directions with plain steel rods. The Department anticipated that this type of bridge would largely replace the construction of wooden pile bridges of similar span. Concrete beam bridges did not become popular until the late 1940s.[35]

Reinforced concrete arch bridges were designed as a viable alternative to the standard steel truss bridge on concrete abutments commonly in use in Saskatchewan in the early 1920s. The earth-filled (closed spandrel) reinforced concrete arch bridge was designed as a viable alternative to the standard steel truss on concrete abutments commonly in use in Saskatchewan at the time. The cost of this type of structure was competitive and had the added advantages of low maintenance costs and a more aesthetically-pleasing form. Unfortunately, the requirement of a firm foundation limited the number of earth-filled arch bridges actually constructed. In spite of this, however, the design did demonstrate the value of reinforced concrete in bridge engineering in Saskatchewan and was a precursor to the reinforced concrete "bowstring" or "rainbow" arch structures which became prevalent throughout southern Saskatchewan in the 1920s and 1930s.

In the bowstring, or tied-arch, design, the floor or road deck was suspended from each arch ring by vertical hangers with the arch ring and deck functioning as a continuous, integrated unit. The tied arch rested on lightly constructed piers that did not require solid rock foundations. This type of arch bridge was well-adapted to crossings where low banks existed, such as in many prairie streams, and provided a larger clearance compared

[35] Neufeld, David, "Saskatchewan Road Bridges, 1898-1951", research report prepared for Saskatchewan Culture, Youth and Recreation, c1989 (no page number).

to an earth-filled concrete arch or concrete beam bridge. The cost was comparable and the design had the added advantages of low maintenance costs and a more aesthetically-pleasing structure. Beginning in early 1921, the Department of Highways drafted standardized plans for spans of 40, 50, 60, 70, 84, and 110 feet. Reinforced concrete bowstring tied-arch structures became prevalent throughout southern Saskatchewan between 1921 and the 1930s, with about ninety of these being constructed (almost half of these in the 1930s). These arch bridges contributed significantly to the improvement of Saskatchewan's provincial road network.

The design of the reinforced concrete rigid frame bridge originated in Germany in the early 1920s and first appeared in Canada in Ontario in 1931. This design differs from other concrete slab structures since the deck and abutments act as a continuous, monolithic structure. Thus, the frame has 'rigid' corners. This type of design is economical for spans up to about seventy feet since the bridge floor at the centre can be significantly thinner. The more efficient profile results in a lower overall height of the structure and reduces the amount of grading required.

Chronology

Prior to the formation of the provincial Public Works Branch (PWB) in 1897, the construction of road bridges was coordinated by members of the Legislative Assembly under a system of district grants. Unfortunately, the lack of technical supervision during design and construction often resulted in bridges that were poorly constructed and "cost much more than they would have done had they been properly designed".[36] With one exception, all the early bridges erected as Territorial public works prior to 1897 were wooden structures.

Starting around **1897** bridges over the larger rivers, such as the Qu'Appelle and Souris, "were bridges of one or more [steel] truss spans", but of various designs. While the Branch recognized that uniformity of design would result in more cost-effective bridges, the lack of technical assistance at headquarters hampered the implementation of this policy.[37] By **1898** the PWB became responsible for designing all small-span (ten to twenty foot) Territorial bridges using a standardized superstructure. Standardized substructures also were designed to suit local conditions. The Branch began to standardize the larger structures by extending "the system commenced during the past year [1897] of putting in steel superstructures for the larger bridges instead of wooden structures as had previously been done".[38] The significant improvements in the methods of manufacturing steel bridges and the keen competition among bridge-building firms in the late 1890s resulted in steel bridges generally becoming cost-effective compared to the equivalent wooden structure, especially for spans greater than 70 feet.[39] The annual expenditures for repairs would be reduced considerably.

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[36] The high costs were attributed to the "unsuitability of the structures erected and the want of proper technical superintendence of their construction".

[37] Annual Report of the Department of Public Works of the North-West Territories, January 2, 1899, p.17.

[38] Annual Report of the Department of Public Works of the North-West Territories, 1898, p.17.

[39] Annual Report of the Department of Public Works of the North-West Territories, 1898, p.19.

Substructures at this time were either pile or frame piers which normally lasted from ten to fifteen years. A program was already in place by the early 1900s to replace wooden piers with concrete, which had a useful life of from twenty-five to forty years.

In the **1898** fiscal year, the PWB constructed 94 bridges throughout Saskatchewan and Alberta. The following year, the Branch constructed 61 bridges, most of which were wooden structures. Seven steel superstructure bridges were built in Saskatchewan in 1899, including bridges over the Antler River and Qu'Appelle River, and at Maple Creek.[40]

In **1900** the Department of Public Works of the North-West Territories owned 953 bridges, of which ninety percent were wooden structures.[41] Many of these were built before the existence of railway lines. By this time many were not well-used since new roads emerged with the arrival of the railways and the creation of new market centres.

In **1901**, the Department made a radical change in the method of constructing bridges in the Territories. Previous to this, all bridges had been constructed under contract but now the Department employed experienced bridge foremen and bridge crews and paid them by the day ('day labour'). This came about because contracts were being undertaken by men with inadequate training and experience. This in turn often resulted in poor cost estimates for the projects such that the lowest bid may not have been realistic. Constant supervision and inspection of the projects was required by Departmental staff which added to the overall cost to the government.[42] To gain some efficiences, timber now was ordered directly for the Branch from BC suppliers rather than each contractor obtaining their own.

In the **early 1900s**, the PWB continued their program on the larger river crossings of building bridges with standard Warren steel-riveted through truss spans. For example, five 80-foot steel trusses were erected over the Qu'Appelle River in 1902. By 1903, the Saskatchewan portion of the NWT had 24 long-span steel bridges (15 of these in the Qu'Appelle basin) with another six being constructed in 1904. Although these steel trusses represented a relatively small part of the Department's overall annual bridge program in the Territories, by the early 1900s steel had been established as the material of choice in many bridge applications. For example, by 1901 there were ten steel truss bridges across the Qu'Appelle River and fifteen in the basin two years later. These permanent crossings addressed the very heavy traffic that resulted "from the haulage of grain from settlements north of the river to market centres on the main line of the Canadian Pacific Railway."[43] The Department owned fifty steel bridges within the Territories by 1901.

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[40] Annual Report of the Department of Public Works of the North-West Territories, 1899, p.29.
[41] Annual Report of the Department of Public Works of the North-West Territories for 1900, p.43.
[42] Annual Report of the Department of Public Works of the North-West Territories for 1901, p.75.
[43] Annual Report of the Department of Public Works of the North-West Territories for 1901, p.72.

In **1903**, the Department constructed their first bridges on concrete foundations over the Oldman and Belly rivers in southern Alberta. That year, a steel truss bridge replaced the old wooden structure over the Qu'Appelle River north of Wolseley "on account of the large settlement north of the Qu'Appelle River doing business at Wolseley".[44]

The program of substituting concrete substructures proved so satisfactory by 1904 that this design approach gradually became accepted as standard practice on the larger crossings.

The bridge building policy of the Department of Public Works evolved in response to the ever-increasing weight of farm 'traction engines'. By the early 1900s, it was recognized that the lighter steel truss bridges were deteriorating more quickly and required more maintenance than heavier steel trusses, such as the Warren truss constructed over the Assiniboine River near Pelly in 1900. The Department recommended by 1906 that the policy should be "to construct heavy steel bridges rather than light steel or timber bridges on account of the more permanent nature of the structures."[45] In addition, these designs should allow for future installation of concrete piers and abutments to reduce maintenance costs.

By **1906**, the Department had implemented standard plans for many bridge structures. This policy made construction more efficient, saved on work in the drafting room and facilitated the shipping of material. By that year the Department's policy was to stop building timber pile trestles and combination trusses for short spans of 25 to 40 feet and to replace these with standard designs of steel structures. The first of these bridges was constructed across Moose Jaw creek, south of Pasqua.[46] At the same time the Department recognized the need to regulate the traffic loads over some of the older, lighter structures as traction engines became heavier. This would become an ongoing problem in the years ahead.

With the construction of Saskatoon's Traffic Bridge and the first steel truss Battleford bridges and the general decision to replace timber piles under all steel trusses with concrete, the provincial government established a cement testing laboratory. This was unique in its day. It is not known whether this facility was located in Saskatoon or Regina.

In the early years, the use of wooden abutments and piers, both for short timber bridges and for spans longer than 20 feet which required a steel superstructure, facilitated the rapid construction of essential bridges "which could not have been attempted if work of a more permanent nature had been insisted on."[47] The Department now began a systematic program of replacing the wooden piers and abutments under existing steel structures with concrete. The first small steel bridge on concrete abutments was erected in 1907 over Wascana Creek near the RNWMP Barracks at Regina. This was a "most substantial

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[44] Annual Report of the Department of Public Works of the North-West Territories for 1903, p.66.
[45] Annual Report of the Department of Public Works for 1906, p.106.
[46] Annual Report of the Department of Public Works for 1906, p.108.
[47] Annual Report of the Department of Public Works for 1907-08, p.16.

structure and should encourage the erection of many more where such are required at points within reasonable distance of railway accommodation."[48]

In addition to the steel structures which by this date were used to span streams of any size, the Department introduced short-span steel I-beam bridges. This design proved economical and satisfied the need for structures to carry the largest 25 ton traction engines.[49]

During the **1907-08** construction season, the Department began to replace the bolts on older steel bridges with rivets. This represented a new approach to steel erection and soon became standard practice.

By **1908**, "except where short span pile trestles can be used, all…bridges are now of steel construction."[50] The old timber truss bridges continued to be replaced with modern steel spans. A special effort was made during the year to bridge the most difficult streams along new lines of railways to give farmers immediate access to the new towns. "Plans were prepared by the Department with a view of standardizing all future steel spans to be erected from 30 to 125 feet" to carry 25 ton threshing and traction engines.[51]

While the steel truss bridges constructed since 1907 had been designed to eventually carry concrete floors, it was recognized by 1908 that this dead weight added too much to the already heavy bridges such that the "idea of providing for concrete floors generally was abandoned"[52] except for special designs. During the 1908 season the Department prepared a set of standard designs for steel highway bridges of spans varying from 30 to 150 feet. Within a year, all sizes of bridges had been standardized and the Department was "now considering the advisability of erecting some small structures of concrete."[53] In addition, corrugated iron culverts began to replace small wooden culverts.

The Department recognized by the early 1900s that steel spans in excess of 150 feet, such as in the Saskatoon and Battleford traffic bridges, would require adopting a different kind of truss. The spans for these bridges are of the "same type as [the] smaller highway bridges, viz., Simple Pratt Trusses, with panel lengths of 25 feet."[54] (This suggests that the earlier steel trusses were the pony rather than through truss style). But the length of panel was too long to safely carry heavy vehicles without using heavier steel. Consequently, "New designs were prepared…with spans of 175, 200 and 250 feet, of the type known as the subdivided or Petit Truss."[55] Thus, by 1909 the Department had established standard designs for steel highway spans ranging from 30 to 250 feet.

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[48] Annual Report of the Department of Public Works for 1907-08, p.8.
[49] Annual Report of the Department of Public Works for 1907-08, p.8.
[50] Annual Report of the Department of Public Works for 1908-09, p.53.
[51] Annual Report of the Department of Public Works for 1908-09, p.55.
[52] Annual Report of the Department of Public Works for 1908-09, p.71.
[53] Annual Report of the Department of Public Works for 1909-10, p.9.
[54] Annual Report of the Department of Public Works for 1909-10, p.91.
[55] Annual Report of the Department of Public Works for 1909-10, p.92.

Early in **1910**, plans were prepared for two bridges, one west of Estevan and one south of Weyburn, constructed of reinforced concrete. These 20-foot RC beam spans had flat slab floors which were reinforced both ways with plain steel rods. The Department believed that "if the construction of this type of bridge is undertaken in sufficient quantity to get the contractors to submit proposals for construction at a fair price, it will soon largely replace the construction of wooden pile bridges of the same span." [56]

By **1911** the province had constructed a few arch bridges "made entirely of concrete reinforced with mild steel bars and also concrete beam spans where the width of the stream will permit these being built economically."[57] RC beam spans up to 60 feet were constructed in 1911 on the main road south of Kindersley, near Yorkton, and near Macdowall.

The Board of Highway Commissioners was formed in April, 1912 to meet the increasing demand for more and better roads in response to "the extension to railroad lines, and consequent location of new towns and settling up of new districts."[58] The Department of Public Works retained the responsibility for construction of timber bridges and steel bridges on timber abutments but worked closely with the Commission on other projects.

The first large 'arches culvert' in Saskatchewan was constructed in 1912. The reinforced concrete parabolic arch structures were well adapted to ravines where considerable fill is required. For the first time the new reinforced concrete beam spans in Saskatchewan were placed on piles.[59]

In mid-August, **1914**, practically all the new road and bridge construction was suspended due to the war.[60] At the same time, the failure of crops in the southwest part of the province necessitated some form of financial relief for the local settlers. The Highway Commission was authorized to carry out road and bridge construction in the area as a priority to ensure some income for the farmers. In the case of steel bridges on pile abutments, the emphasis was placed on preparing the timber abutments since the erection of the steel spans required more skilled labour. Many of these steel bridges were completed in 1915.

In **1917**, Engineers of the Department of Highways designed and constructed the first reinforced concrete closed spandrel arch bridge (also known as an earth-filled arch bridge) "as an alternative design to [the] standard construction of a steel truss on concrete abutments."[61] The first of these concrete deck arch bridges was a 50-foot span erected over the Whitesand River near Yorkton. In early 1918, a second one, with a 72-foot span, was completed across the Qu'Appelle River near Fairy Hill on the main highway north from Regina. Both structures replaced old timber bent bridges. A third 64-foot span was

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[56] Annual Report of the Department of Public Works for 1909-10, p.92.
[57] Annual Report of the Department of Public Works for 1911-12, p.8.
[58] Annual Report of the Department of Public Works for 1912-13, p.7.
[59] Annual Report of the Department of Public Works for 1912-13, p.36.
[60] Annual Report of the Board of Highway Commissioners for 1914-15, p.5.
[61] Annual Report of the Department of Highways for 1917-18, p.7.

constructed later in 1918 over the Arm River near Craik.[62] The cost was similar to a steel bridge with the added advantage that there would be no future maintenance costs. In addition, these bridges were considered to be more aesthetically pleasing. Standardized plans had yet to be prepared for this type of structure.

In **1919,** the Department constructed a specially-designed reinforced concrete truss bridge over Wascana Street in the southeast part of Regina at the historic McKell's Crossing.[63] This bridge, which replaced an old pile bent structure which was built in 1885 and then replaced in 1902 by five 20-foot timber spans, was completed in the spring of 1920 and is still actively used. This design has both vertical and diagonal members and structurally is similar to a steel truss. This was the only reinforced concrete truss bridge constructed in Saskatchewan. This design was superceded by the reinforced concrete "suspended arch" bridge without diagonal members.

The first reinforced concrete 'suspended arch' bridge erected in the province was constructed in **1921** over Bone Creek south of Tompkins in the RM of Carmichael No. 109. It was a 60-foot span and replaced an older pile bent structure.[64] It has since been replaced by two large culverts. This bridge differed in design from the reinforced concrete truss bridge by having vertical, rather than diagonal, hangers. This type of structure, which is often referred to as a 'rainbow' or 'bowstring' concrete arch bridge (as differentiated from the bowstring steel arch bridge), became popular for smaller crossings until the late 1930s and more than ninety of these structures eventually were constructed throughout the province. Multiple-arch bowstring bridges were erected at several longer crossings. Many of these structures still exist in Saskatchewan, although they have often been abandoned by new highway alignments.

Between the establishment of the province in 1905 and the end of the 1921 construction season, the government had built 2057 timber bridges, 252 steel bridges, and 30 all-concrete bridges.[65]

The relative importance of concrete in bridge construction during the early 1920s and into the 1930s is reflected in the erection of eight such bridges in 1921 alone. These included three concrete beams, two suspended arch, and three closed spandrel arch bridges.[66] In 1923, 12 all-concrete bridges were built; by the end of the 1924 season, there were five double-span concrete suspended floor reinforced concrete bridges in service in Saskatchewan. In 1930, twenty-five reinforced concrete bridges were constructed with twenty-two of these being bowstring arches.[67] No reinforced concrete bridges were built in either 1932 or 1933 due to the onset of the Depression.

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[62] Annual Report of the Department of Highways for 1918-19, p.36.
[63] The Public Service Monthly, Vol. VIII, No.9, Regina, April 1920, p.1.
[64] Annual Report of the Department of Highways for 1921-22, p.28.
[65] Annual Report of the Department of Highways for 1921-22, p.26.
[66] Annual Report of the Department of Highways for 1921-22, p.28.
[67] Annual Report of the Department of Highways for 1930-31, p.96.

The early Depression years saw the provincial bridge construction program largely restricted to repairing existing bridges. There also was a drastic reduction in Bridge Branch staff.[68] In 1933 the Branch prepared designs for proposed major traffic bridges near Ceepee (Borden), Outlook and at Saskatchewan Landing. Foundation surveys were undertaken for the Ceepee site.[69]

Throughout the **1940s** Saskatchewan Highways and Transportation was under increasing pressure to maintain and replace the aging bridge infrastructure, particularly the timber bridges. By 1944 the Department had constructed 3 174 bridges. About forty percent of these were older than twenty years and needed to be replaced, but with regular program funding, the Department could only replace about fifty of these bridges a year. In addition, the division of responsibility between rural communities and the Department with regard to repair and replacement of timber bridges on municipal roads was unclear.[70] These issues seem to have reached the critical stage in the 1940s but the challenges of funding and distribution of responsibility had existed for several decades. Indeed, bridge inspection, maintenance and replacement, as well as roads, are issues that surface on a regular basis during the annual conventions of the Saskatchewan Association of Rural Municipalities, among other lobby groups.

Railway Bridges

Evolution of Saskatchewan's Railway Network

The railway network in the western interior developed in three stages: the pioneer era, 1882-1893; the pre-First World War boom, 1893-1913; and, the 1920s boom.[71] The first phase saw the completion of the Canadian Pacific Railway (CPR) main line across Saskatchewan and the construction of several branches. The second phase involved considerable expansion of rail lines and the competition between the CPR and the Canadian Northern and Grand Trunk Pacific railways. The last phase was characterized by intense competition between the CPR and Canadian National Railways, particularly in northern Saskatchewan.

Canadian Pacific Railway

In 1870 John A. Macdonald's government developed a plan to provide a rail link between British Columbia and eastern Canada. This resulted in the formation of the Canadian Pacific Railway Company in February, 1881 which became in effect an instrument of national policy with the purpose of fostering national unity, promoting settlement, and stimulating economic growth. Since private investment was insufficient to undertake this massive endeavour, Ottawa reserved 25 million acres of western lands for the railway and

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[68] Annual Report of the Department of Highways for 1932-33, pp.21-22.
[69] Annual Report of the Department of Highways for 1933-34, p.20.
[70] Annual Report of the Department of Highways and Transportation for 1943-43, p.7.
[71] Kozma, Leslie S., "A Survey of Railway Bridges in Saskatchewan: 1882 to 1996", report prepared for the Saskatchewan Heritage Foundation, 1996.

provided a subsidy of $25 million. The railway company could then sell these railway blocks to generate capital to pay for the line.

By the end of 1881 the track had reached Brandon and a year later it reached Swift Current. The construction of the CPR across the southern plains by the early 1880s shifted the pattern of settlement from established centres such as Battleford and Prince Albert to the south as new towns either sprang up in advance of the CPR main line or along the railway.

Between 1885 and 1890, the Qu'Appelle Long Lake and Saskatchewan Railway completed a line from Regina to Prince Albert via Craik, Saskatoon and Rosthern. This was immediately leased to the CPR and subsequently purchased by the Canadian Northern Railway in July, 1906.[72] The CPR also built some branch lines in the 1890s including the "Soo Line" from North Portal to Moose Jaw connecting to Chicago, and branches connecting Brandon to Estevan and Arcola. The CPR also leased the Manitoba and North Western Railway line which reached Yorkton in 1890.

People in the prairies in the late 1880s generally were not satisfied with the monopolistic service provided by the CPR. The CPR's high freight rates meant that farmers "who were more than ten miles from the nearest railway delivery point could ship their products only at a high cost and with great exertion."[73] The fact that no new track was laid in Western Canada between 1893 and 1896 only added to this discontent. Two new western railway lines would soon provide competition to the CPR and change the pattern of settlement in Saskatchewan.

Canadian Northern Railway

The Canadian Northern Railway was formed by William Mackenzie and Donald Mann on January 13, 1899 through the amalgamation of the Winnipeg Great Northern Railway and the Lake Manitoba Railway and Canal Company. The CNoR obtained a charter to extend the line from Swan River, Manitoba to Prince Albert with the condition that this be completed within two years. By March 1901 the line had reached the Red Deer River in east-central Saskatchewan but soon was bogged down by muskeg and heavy bush.[74] Without easy access from the east by railway, however, settlers began to ignore the north and started to homestead on land between Davidson and Battleford. Although the CNoR line to Prince Albert was surveyed by June 1902, the optimism that the railway would reach Prince Albert in 1902 and Edmonton in 1903 quickly vanished,[75] particularly when the CNoR decided to focus on their main line through Humboldt and Battleford.

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[72] Eagle, John A., The Canadian Pacific Railway and the Development of Western Canada, McGill-Queen's University Press, 1989, pp.86-87.
[73] Regehr, T.D., The Canadian Northern Railway: Pioneer Road of the Northern Prairies, 1895-1918, The Macmillan Company of Canada, 1976, p.21.
[74] Abrams, Gary W.D., Prince Albert: The First Century, 1866-1966, Modern Press, 1966, p.113.
[75] Abrams, Gary W.D., Prince Albert: The First Century, 1866-1966, Modern Press, 1966, p.128.

By January 1903, the CNoR line finally was laid west of the Red Deer River near Hudson Bay, Saskatchewan but it would be three more years before the CNoR line would actually reach Prince Albert. In 1903, Laurier's Liberal government passed legislation to support the further development of the Canadian Northern Railway (as well as the Grand Trunk Pacific Railway). This ensured the immediate survival of the CNoR.

In keeping with the company's philosophy of claiming as much territory and generating as much local traffic as possible, the CNoR developed four main trunk lines in the North-West Territories. The original intention was to make their main line to Edmonton the more northerly route through Dauphin, Tisdale and Melfort to Prince Albert and North Battleford but this plan changed in 1901 when the line from Dauphin and Grandview, Manitoba through Warman and Battleford to Edmonton became a higher priority.[76] The political and economic influence of Prince Albert, however, ensured that both lines received federal assistance. It became 'politically-correct' to refer to both lines as 'main' lines.

The construction of both northerly main lines was started in 1903. The development of the Marquis variety of wheat in 1904, which ripened ten to fourteen days earlier than other varieties, made extensive wheat farming on the northern prairies possible. Coupled with better rainfall amounts in the early 1900s, and new settlers from the United States who better understood soil moisture conservation techniques, conditions were now favourable for a further expansion of the CNoR network.

The progress of the lines was remarkable. For example, in 1905 tracks were laid from Kamsack to Edmonton and from Melfort to Prince Albert. The northern line entered Prince Albert in January 1906.[77] The CNoR provided competition for the Qu'Appelle, Long Lake and Saskatchewan Railway line which ended in Prince Albert. This competition resulted in a sharp drop in freight rates and brought in more settlers to the region. Completion of the two main lines across the prairies had firmly established the CNoR as *the* railway of the northern prairies.[78]

To complete their northern route to Edmonton, the CNoR needed to bridge the North Saskatchewan River at Prince Albert. Once across the river, the line would split with one going straight north to Paddockwood and the other west to Shellbrook.[79] Although the CNoR started the line to North Battleford in 1909, the company paused at Shellbrook to build a line to Big River. Consequently, the line to North Battleford was not completed until 1914.[80]

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[76] Regehr, T.D., The Canadian Northern Railway: Pioneer Road of the Northern Prairies, 1895-1918, The Macmillan Company of Canada, 1976, p.167.
[77] Silversides, Brock V., Gateway to the North: A Pictorial History of Prince Albert, 1989, Western Producer Prairie Books, Saskatoon, p.76.
[78] Regehr, T.D., The Canadian Northern Railway: Pioneer Road of the Northern Prairies, 1895-1918, The Macmillan Company of Canada, 1976, p.201.
[79] The line to Shellbrook was completed in 1910.
[80] Abrams, Gary W.D., Prince Albert: The First Century, 1866-1966, Modern Press, 1966, p.148.

The CNoR had focused on occupying the northern prairies and, although this delayed the completion of their transcontinental line, it ensured profitable operations from the beginning without the need for high freight rates.[81] The CNoR recognized that "most of the traffic that was needed to make their railway profitable would either originate on, or be destined for, the prairies."[82] Their policy of developing a strong network of branch and feeder lines before building the long transcontinental connections was instrumental in opening up the country north and west of Prince Albert. By 1915 the CNoR system comprised 9,362 miles of trackage.[83]

It has been estimated that the CNoR "was directly responsible for the establishment of more than 550 prairie cities, towns, and villages which had been nonexistent before the coming of the railway. Obviously many of the new settlers occupied homesteads, towns, and villages opened by the Canadian Northern."[84] The impact of the CNoR, while not as significant as the CPR, was particularly important to the northern prairies.

Grand Trunk Pacific Railway

The Grand Trunk Pacific Railway was the last national railway to arrive in western Canada. It was incorporated in 1903 as a subsidiary of the Grand Trunk Railway of Canada. As part of the government-sponsored transcontinental system, the GTP main line, which was constructed between 1905 and 1914, ran from Winnipeg via Melville, Edmonton, and Jasper to Prince Rupert, British Columbia. It was completed in 1908 through Melville, Watrous, Saskatoon and as far as Biggar. The company also built several branch lines including Melville to Regina, Moose Jaw and Central Butte, and Regina south to Lampman and Northgate. In July, 1906 the GTP had secured a charter to build a branch line to Prince Albert from Young on its main line.[85] Unfortunately, by 1910 only 25 miles of this branch line had been constructed.[86] The line had been extended north to Wakaw by the end of 1912.[87] The line finally reached St. Louis in 1913.[88] A significant bridge was required to cross the South Saskatchewan River at St. Louis before the GTP could extend its line into Prince Albert in 1917.

This competition resulted in the CPR completing several additional branch lines. For example, the line from Stoughton to Regina was completed in 1904, and the branch from Wolseley to Reston, Manitoba in 1906.[89] The branch from Esterhazy to Lanigan was completed in 1907 and reached Saskatoon, Wilkie and Edmonton in 1908. An additional

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[81] Regehr, T.D., The Canadian Northern Railway: Pioneer Road of the Northern Prairies, 1895-1918, The Macmillan Company of Canada, 1976, p.159.
[82] Regehr, T.D., The Canadian Northern Railway: Pioneer Road of the Northern Prairies, 1895-1918, The Macmillan Company of Canada, 1976, p.163.
[83] See http://www.railways.incanada.net/candate/candate.htm
[84] Regehr, T.D., The Canadian Northern Railway: Pioneer Road of the Northern Prairies, 1895-1918, The Macmillan Company of Canada, 1976, p.458.
[85] Abrams, Gary W.D., Prince Albert: The First Century, 1866-1966, Modern Press, 1966, p.145.
[86] Abrams, Gary W.D., Prince Albert: The First Century, 1866-1966, Modern Press, 1966, p.149.
[87] Abrams, Gary W.D., Prince Albert: The First Century, 1866-1966, Modern Press, 1966, p.177.
[88] Abrams, Gary W.D., Prince Albert: The First Century, 1866-1966, Modern Press, 1966, p.216.
[89] Eagle, John A., 1989, The Canadian Pacific Railway and the Development of Western Canada, McGill-Queen's University Press, p.101.

line was built from Moose Jaw northwest to Outlook, Rosetown and Macklin. The line from Regina to Saskatoon was started in 1907 and the bridge over the South Saskatchewan River at Saskatoon was built by the end of that year. Almost 350 miles of branch lines were constructed by the CPR in Saskatchewan in 1910.[90]

Competition in Western Canada from both the Canadian Pacific Railway and Canadian Northern Railway, as well as high construction costs, the necessities of wartime financing,[91] and the lack of a viable system of branch lines, forced the Grand Trunk Pacific into receivership in 1919. The operations of the Grand Trunk, the Grand Trunk Pacific, and the National Transcontinental Railway merged with those of the already nationalized Canadian Northern Railway to form the Canadian National Railways (CNR), which later became Canadian National.

Canadian National Railway

When the CNR was formed, the company's policy was to populate the vacant land crossed by their rail system. From 1927 to the Depression years, the "CNR brought in over 60% of all immigrants arriving in Canada from overseas."[92]

After the First World War the CNR constructed lines to Carrot River, Spiritwood and Willow Bunch and from Sturgis to Hudson Bay. The CPR also built major branches to Nipawin, Prince Albert and Meadow Lake.

By 1900, Canada had 19 000 miles of track, which on a per capita basis was more than any other country.[93] This had increased to 38 000 miles by 1916.

Saskatchewan's Railway Bridges

Historical Context

Railway bridge construction began in the province when the Canadian Pacific Railway's main east-west line entered what is now southern Saskatchewan in 1882. As noted previously, this had the initial effect of shifting the pattern of settlement from established towns such as Prince Albert and Battleford to further south as new towns sprang up. One such town was Regina. While it was anticipated by many squatters and land speculators that the CPR route would cross Pile of Bones (Wascana) Creek about 10km north of the present site of Regina, the CPR decided to erect a bridge at a surveyed site immediately west of what would become Regina. Like virtually all of the bridges constructed on the initial CPR roadbed, this was a simple timber structure. The CPR reached Wascana Creek on August 23, 1882. At the same time, the lieutenant-governor of the North-West Territories, Edgar Dewdney, recommended that the capital be transferred from

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[90] Eagle, John A., 1989, The Canadian Pacific Railway and the Development of Western Canada, McGill-Queen's University Press, p.103.
[91] Most of the financial investors were from England.
[92] Landry, Nicolas, "The CNR and western settlement, 1925-1930", *The Archivist*, May-June, 1990, p.14.
[93] Fung, Ka-iu, editor, Atlas of Saskatchewan, 1996, University of Saskatchewan.

Battleford, which had held this distinction since 1876, to Regina. The official transfer took place in March, 1883.[94]

The early citizens of Battleford had been optimistic that the CPR would extend its line northward through their community to Edmonton, especially since a railroad route had been surveyed through there in 1871, but in 1881 the company decided on a more direct southerly route to the Pacific from Winnipeg through the Kicking Horse Pass. Hopes were again raised in Battleford some twenty years later when the Canadian Northern Railway was expanding westward. Unfortunately for the community the CNoR elected to bypass Battleford and start a new townsite, North Battleford, on the north side of the North Saskatchewan River, reaching there in 1905. Battleford finally would get its rail connection in 1912, when the GTPR extended its line from Swift Current through Biggar to Battleford. The temporary bridge over the Battle River leading into Battleford incorporated 93 timber trestle spans with an overall length of about 320 metres. In 1924 the bridge was shortened and two steel through truss spans replaced the central trestles. The original timber trestle approaches were replaced in 1942. Although the rail line was discontinued many years ago, the bridge over the Battle River has become a landmark in the community. North Battleford, along with many other communities across the Prairies, such as Regina, Moose Jaw, Swift Current, Kamsack, and Kindersley, owed their existence and prosperity to the railways.

The first significant rail line to northern areas prior to the early 1900s was the Qu'Appelle Long Lake and Saskatchewan Railway which connected Regina to Prince Albert via Saskatoon. The formation of the Canadian Northern Railway in 1899 offered the promise of opening up more northerly areas of the province to settlement but when the line ran into difficult terrain west of Hudson Bay, Saskatchewan in 1901, the CNoR diverted their resources to a more southerly route through Humboldt to Battleford. Settlers began to ignore the north and to homestead on land between Davidson and Battleford. In spite of this setback to development, Saskatchewan experienced a significant northerly expansion of railway lines in the first decade of the 1900s. This period was marked by the construction of major railway bridges across the South Saskatchewan River at Saskatoon and downstream at Fenton, with Saskatoon becoming a divisional center for both the CPR and the GTPR. The Qu'Appelle Long Lake and Saskatchewan Railway had constructed the first railway bridge there in 1905. This was followed a few years later by large bridges over the South Saskatchewan River at both St. Louis and Outlook. In addition, a large railway bridge was completed during this period over the North Saskatchewan River at Prince Albert.

Types of Railway Bridges

The early railway bridges in Saskatchewan were typically constructed from timber since this provided the cheapest construction material and these structures could be erected quickly. This expedited the laying of track and thereby generated immediate revenue for the railway company. These timber bridges were either wood trusses, timber pile trestles, or a combination of pile and frame trestles. The wooden through trusses were generally

[94] Brennan, J. William, 1989, Regina: An Illustrated History, James Lorimer & Co., p.12.

of the Howe type.[95] This type of structure, which was patented by William Howe in 1840, was often the most efficient bridge for small to medium sized stream crossings because wood was a relatively cheap material and the structure required a minimum amount of more expensive steel. The use of wooden Howe trusses generally was discontinued by the First World War and replaced by steel truss structures.

By the early 1880s, timber trestle bridges had become popular throughout Western Canada as the CPR had begun to standardize and partially prefabricate many of its larger bridges.[96] But reducing construction costs was only a temporary solution since the increasing weight and speed of trains necessitated the erection of bridges that were more rigid and had a larger carrying capacity. Thus, by the early 1900s, steel on concrete foundations would begin to dominate the construction of the larger railway bridges, although timber structures would occasionally be built. A late example of the timber trestle bridge is the one constructed in 1929 by the Canadian National Railway over McCloy Creek west of Melfort. This structure was designated a Municipal Heritage Property in 1981 and is one of the largest timber trestle bridges ever constructed in Saskatchewan.

In many cases, the wooden trestle bridges were temporary structures which were subsequently filled by earth or replaced by more permanent steel structures after the track had been laid.[97] From an engineering perspective, it was recognized that trestles should only be used as either temporary structures or for crossing deep and wide ravines or where the cost of the embankment would exceed the initial cost of the trestle and the subsequent cost of filling. For example, the CPR line from Weyburn to Lethbridge had an inordinate number of large trestle bridges due to the rolling nature of the Missouri Coteau in this part of south-central Saskatchewan.

Canadian Northern Railway engineers tended to rely on timber trestle bridges rather than on culverts and earth embankments, particularly when crossing deep ravines. Through rolling prairie it was more common to construct short earth fills with culverts than trestle bridges.

Whenever feasible, the railway companies would lay the track through small lakes and sloughs by using wooden box culverts and water diversion ditches. Diverting small water courses and filling the crossing with earth often proved to be the cheapest solution. In extreme cases, such as construction of the CPR Rush Lake line in 1905, the lake was partially drained. In some locations, the track would have to be carried around these geographical features. An example of this is the CPR timber trestle and causeway constructed at the south end of Last Mountain Lake.

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[95] Macintyre, D.E., 1973, End of Steel, Martin Associates, Toronto, p.75.
[96] Ball, Norman R., (ed.), 1988, Building Canada: A History of Public Works, University of Toronto Press, p.17.
[97] Kozma, Leslie S., "A Survey of Railway Bridges in Saskatchewan: 1882 to 1996", report prepared for the Saskatchewan Heritage Foundation, 1996.

Throughout the early 1900s the railway companies turned to alternate construction techniques such as steel deck plate girders. This approach became more common as timber structures reached their normal life spans and the ever-present threat of fire became a serious issue. Plate girders found an important use in the construction of steel viaducts that cross wide and deep valleys, such as at several crossings of the Saskatchewan River system.

By the mid-point of the Twentieth Century, most of the rail lines and bridges in Saskatchewan had been completed. Work was then focused on maintaining and repairing existing bridges, although occasional replacement of bridges, such as the older wooden structures, would be essential.

According to Kozma, over 1900 railway bridges have been constructed in Saskatchewan. While many of these are relatively short, approximately 60 exceed about 500 feet in overall length and could be considered as significant engineering achievements. Several of these accommodated road traffic, either as lateral attachments, such as at St. Louis and Prince Albert, or have a separate roadway beneath the rail deck, such as the Crooked Bridge at Nipawin.

Conclusions

Saskatchewan's road and railway bridges evolved in response to the ever-increasing demands by its residents for better transportation networks and in response to the development of bridge engineering technology. The first bridges were timber structures which could be erected quickly and economically and often with local, unskilled workers. Larger and more permanent road and railway structures began to be erected in the early 1900s from steel and were often supported on concrete piers. By the 1920s, reinforced concrete structures in various forms had displaced steel for many highway bridges. Concrete was to remain the preferred medium throughout the following decades.

While Saskatchewan generally exhibited a conservative approach to their highway bridge designs, often following the lead of Ontario, the province did create traffic bridges of considerable engineering merit. Examples of these include the Broadway Bridge and University Bridge in Saskatoon, the Ceepee Bridge near Borden, and the Albert Memorial Bridge in Regina. The railway companies also constructed significant structures at Prince Albert, Outlook, Nipawin and at St. Louis, among others. Several of these road and railway bridges, as well as other representative examples, are excellent potential candidates for Provincial heritage designation under Saskatchewan's *Heritage Property Act*.

Additional research into the province's road and railway bridges will further contribute to a more-informed understanding of this significant part of Saskatchewan's built heritage.

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